

FOLIAGE PLANTS FOR REMOVING AIR POLLUTANTS
FROM ENERGY-EFFICIENT BUILDINGS

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SUMMARY

Trace-gas orbital workshop atmospheric samples were obtained during the Skylab missions. The results of those analyses indicated the presence of more than 300 compounds in the Skylab atmosphere during the occupancy of the Skylab III crew. Of this number, 107 were identified by mass spectral methods. Table 1 gives the concentrations of 12 of the 107 volatile organics identified on the 11th, 46th, and 77th days of the mission.

This gives some indication of the indoor air pollution problem that can be expected when ventilation is significantly reduced.

In an effort to develop a practical means of preventing the accumulation of toxic substances in the atmosphere of future space stations and energy-efficient buildings on Earth, NASA has been evaluating the use of biological processes.

Recently, research at NASA's National Space Technology Laboratories (NSTL) in Mississippi has demonstrated the ability of common houseplants such as spider plants (*Chlorophytum elatum* var. *vittatum*) and golden pothos (*Scindapsus aureus*) to remove such indoor air pollutants as formaldehyde and carbon monoxide from closed chambers.

The spider plants proved to be very effective in removing up to 2.27 μg of formaldehyde and 2.86 μg of carbon monoxide per square centimeter of leaf surface area during a 6 hour photo period. The golden pothos removed 0.46 μg of formaldehyde and 0.98 μg of carbon monoxide per square centimeter of leaf surface under the same test conditions. With a leaf surface area of 6,500 square centimeters per average size plant, 8 to 15 spider plants should be sufficient to meet the formaldehyde and carbon monoxide air

purification needs of an average home, Figure 1.

A concept for using a combination of activated carbon and plant filters for single homes and condominiums is demonstrated in Figures 2 and 3. Plant concepts for office buildings which include air purification and wastewater/air treatment combinations are demonstrated in Figures 4 and 5.

TECHNICAL REFERENCES

1. Wolverton, B. C., R. C. McDonald, and H. H. Mesick. 1984. Foliage plants for indoor removal of the primary combustion gases carbon monoxide and nitrogen dioxide. Accepted for publication by *Journal of the Mississippi Academy of Sciences*, December 1984.
2. Wolverton, B. C., R. C. McDonald, and E. A. Watkins, Jr. 1984. Foliage plants for removing indoor air pollutants from energy-efficient homes. 1984. *Economic Botany*, 38(2):224-228.

FIGURE 1

Green Plants for Air Purification in Energy-Efficient Homes

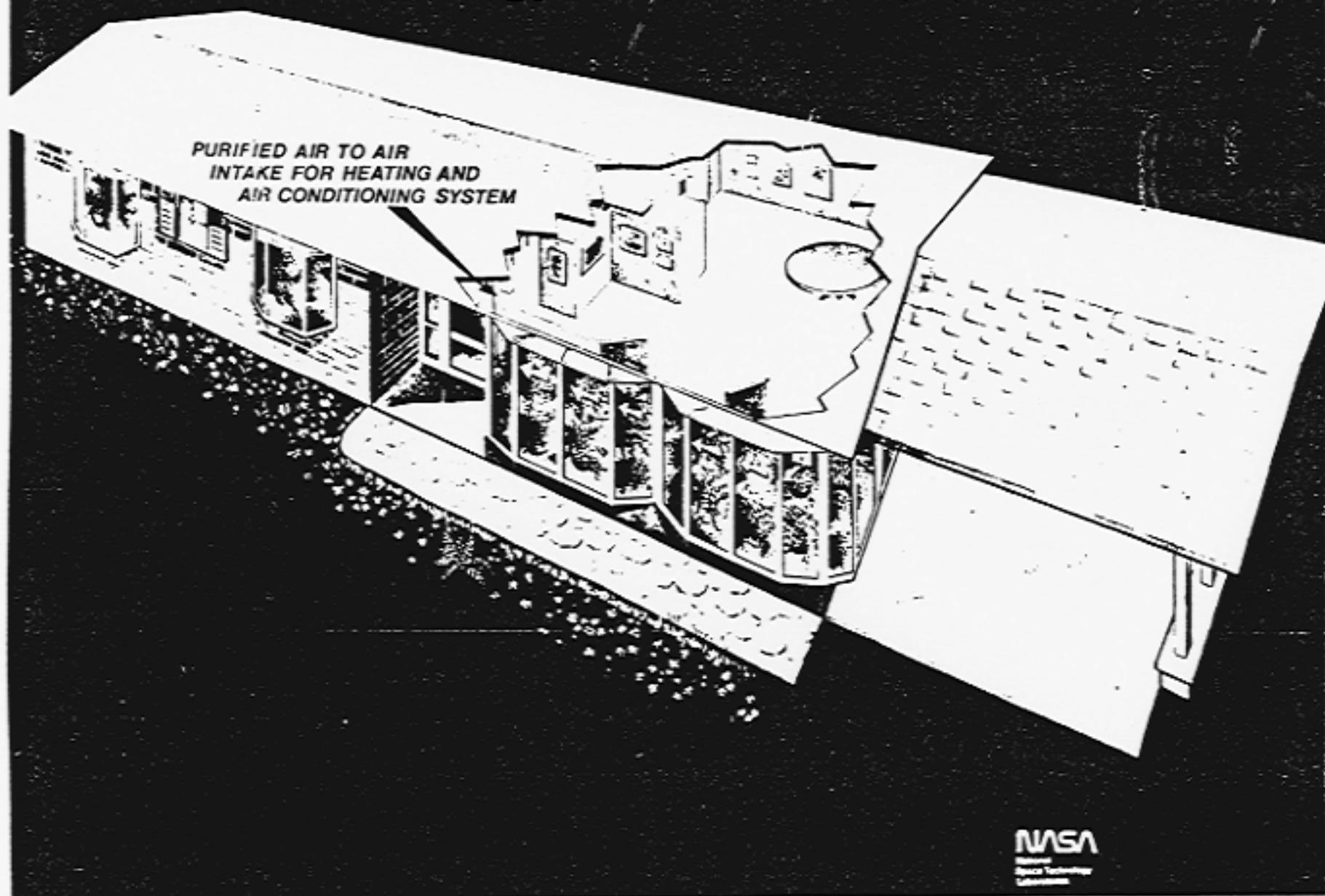


TABLE 1

Twelve of the 107 Volatile Organics Identified in the Atmosphere of Skylab 3.

Organic	Concentration, ppb		
	11th Day	46th Day	77th Day
Acetone	7895.0	7098.0	2760.0
Freon-112 & 113	5907.0	8553.0	8446.0
Toluene	1647.0	1040.0	1717.0
2-Butanone	1505.0	1222.0	665.0
Xylene (total)	515.0	384.6	406.5
Ethylacetate	454.0	390.0	221.0
Dichloroethane	454.0	224.0	213.0
Benzene	116.0	70.1	38.6
Benzaldehyde	114.0	62.4	102.0
Heptene	88.0	52.0	116.0
Dichlorobenzene	25.6	13.0	24.8
Naphthalene	90.9	59.8	113.0

FIGURE 2

INDOOR AIR PURIFICATION SYSTEM COMBINING HOUSEPLANTS AND CHARCOAL FILTERS

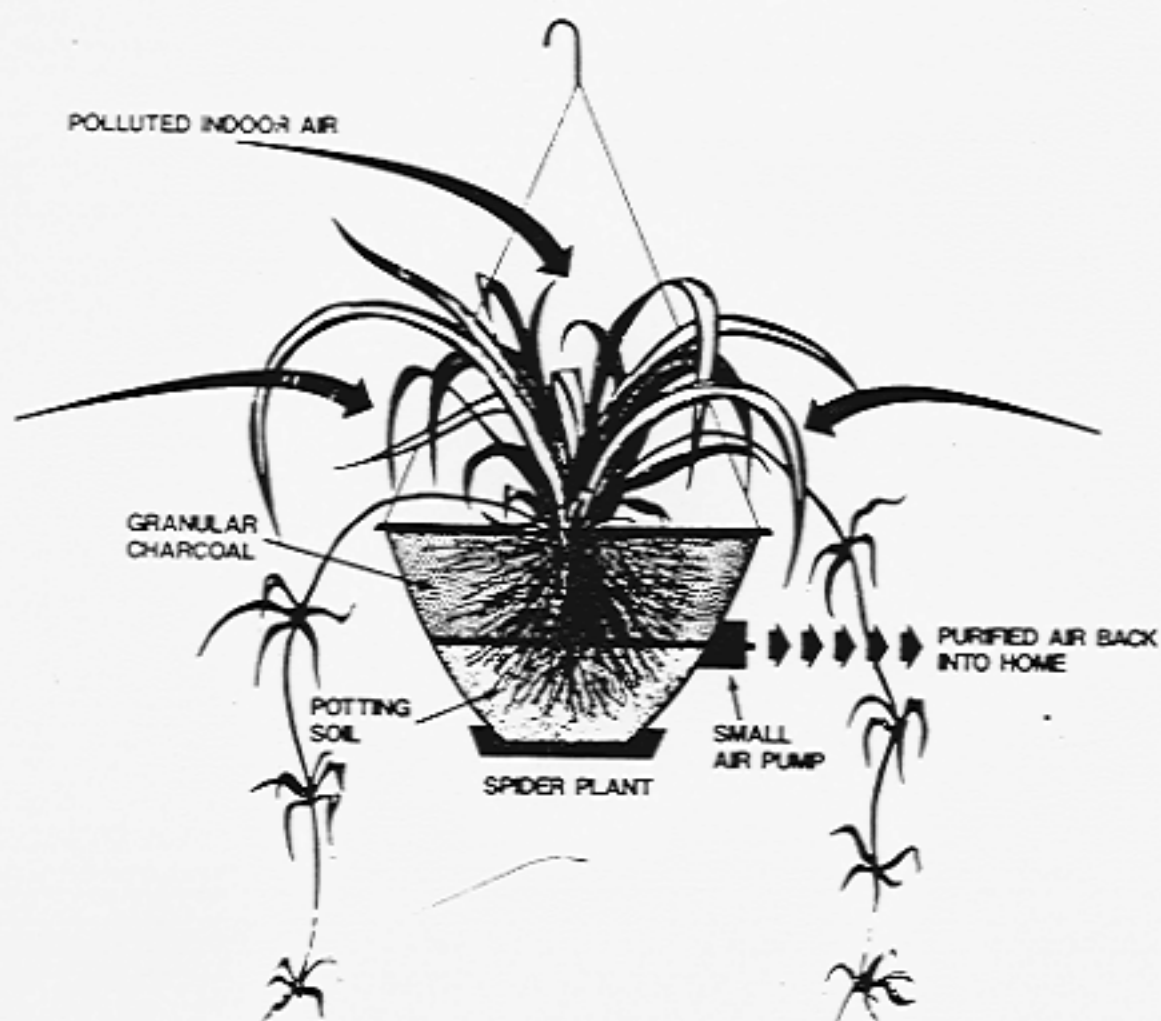


FIGURE 3

WINDOW PLANTER COMBINED CARBON AND SPIDER PLANT FILTER SYSTEM FOR REMOVING INDOOR AIR POLLUTANTS FROM ENERGY EFFICIENT CONDOMINIUMS.

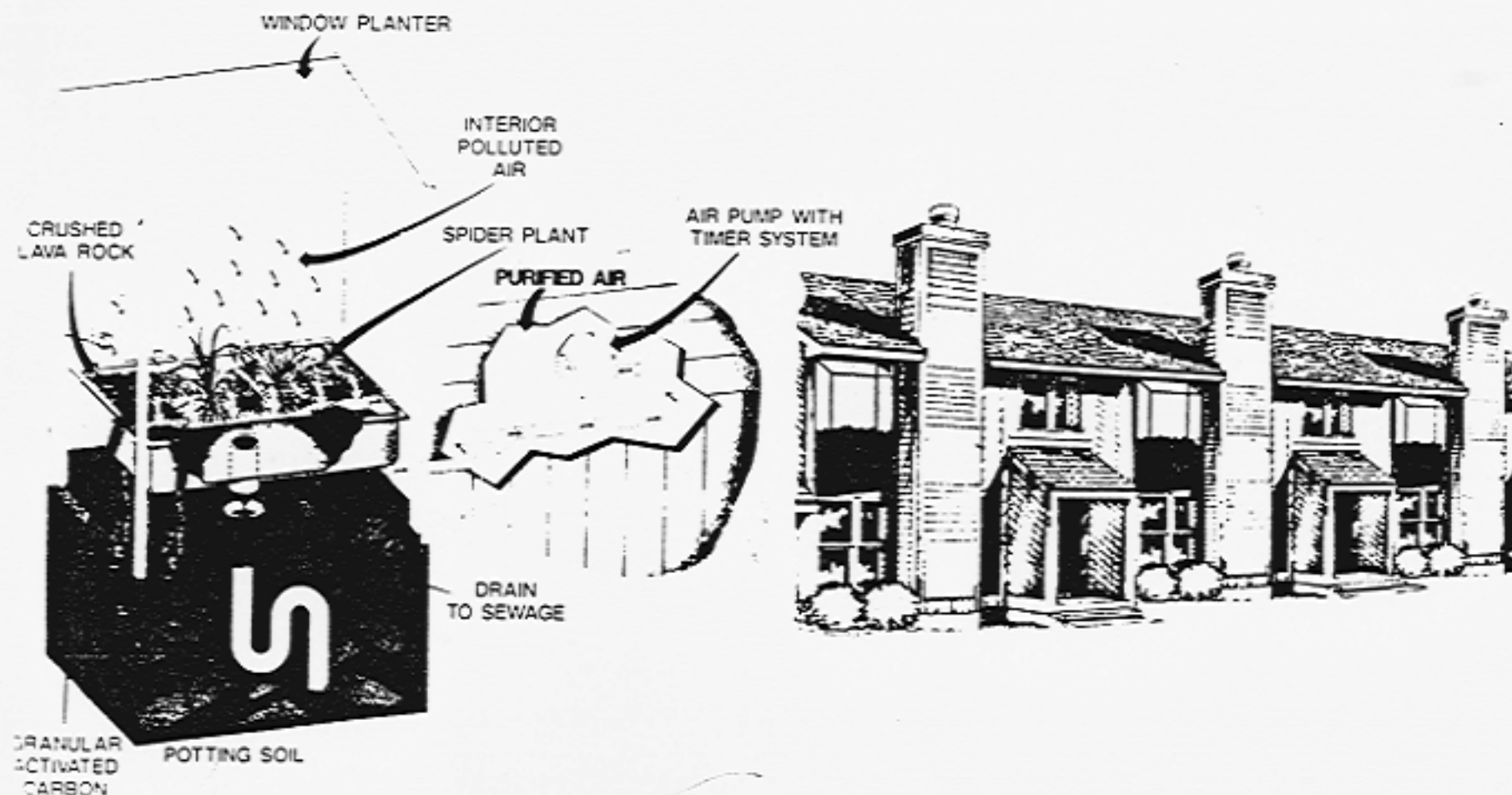


FIGURE 4

PLANT SYSTEM FOR PURIFICATION AND REVITALIZATION OF ATMOSPHERE INSIDE ENERGY EFFICIENT BUILDINGS

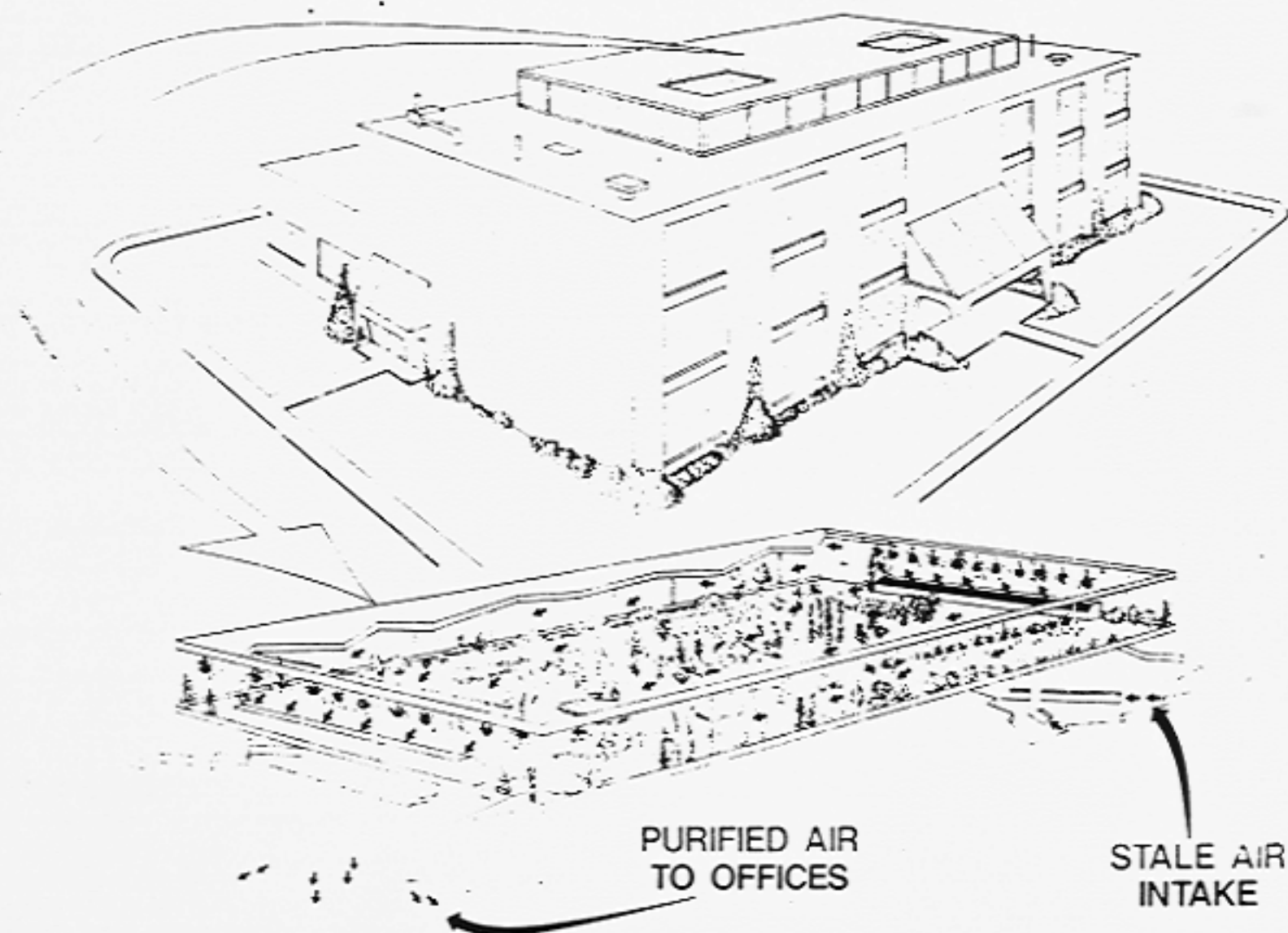


FIGURE 5

BIOLOGICAL AIR AND WASTEWATER TREATMENT SYSTEM FOR ENERGY EFFICIENT BUILDINGS

